

night they are supplied with an ordinary mug and a small basin to hold soiled handkerchiefs, which, by the way, are made of paper. The minimum time of residence is three months.

With hope, care, rest, and the beauty of their surroundings, all improve and very many entirely recover.

Many questions were asked about our American hospitals and methods of nursing, and the eagerness with which my own inquiries were met and the unfailing courtesy shown me set me thinking, on withdrawing my footsteps from this beautiful place, how very rich and satisfying life can be made by the knowledge we may gain every day of the practical side of it, in all its various phases, and the store of experience we may thereby lay up for our future guidance and profit.

As an able author truly says: "Were I asked what best dignifies the present and consecrates the past; what alone enables us to draw a just moral from the Tale of Life; what sheds the purest light upon our reason; what gives the firmest strength to our religion; what is best fitted to soften the heart of man and elevate his soul,—I would answer, with Lassues, it is Experience."

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## BACTERIA IN THEIR RELATION TO HEALTH AND DISEASE \*

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MANY years ago Robert Koch laid down three definite rules for determining whether a given bacterium is pathogenic and the cause of the disease in question. These rules are: *First*, it must be proved to be present in all cases of the disease; *second*, it must be present in this disease and in no other, since otherwise it could not produce a special definite action; *third*, it must occur in such quantities and be so distributed within the tissues that all the symptoms of the disease may be clearly attributable to it.

Let us now consider a few of the more common forms of bacteria which have been proved to be pathogenic when introduced into the tissues of animal organisms.

In all the countries of the Old World except England there are yearly epidemics of a very irritant infectious disease among cattle, which is known as splenic fever, or *anthrax*. This disease occurs in America

\* Read before the nurses of Rochester City Hospital.

only in isolated cases, while in Siberia it is so extensive and so destructive as to have received the name of the Siberian pest. The study of its cause was one of the first steps into the realm of bacteriology. It was found that a rod-shaped micro-organism, now known as the *bacillus* of *anthrax*, is always present in the blood of animals suffering from this disease; that pure cultures of the bacillus can be made from the tissues of these animals, and that these cultures when introduced into the body of a susceptible animal again produce anthrax. When these bacilli gain entrance to a human body they produce disease, it is true, but usually a local disease simply, as man is not highly susceptible to this infection. In man the disease is known as malignant pustule. Men whose occupations require them to be near cattle or to handle the hair or skin of those animals are the most frequent victims. They are usually inoculated through cuts, scratches, or other lesions of the hands or face. As anthrax is not common among American cattle we see very little of the allied disease in man.

There is an old German maxim which says that "Everyone has, after all, a little tuberculosis." When we consider that one-seventh to one-fifth of all deaths at all ages are due to the tubercle bacillus, we are willing to admit that the saying is not much of an exaggeration. Robert Koch won his greatest renown when, on March 24, 1882, he reported to the Physiological Society in Berlin that he had found the cause of tuberculosis—a peculiar bacillus of a special shape. This bacillus of tuberculosis is one of the most difficult to cultivate. Koch's method of procedure when he demonstrated the bacillus is practically the one used to-day in cultivating it. Koch completed his chain of evidence by inoculating susceptible animals from his pure cultures of the bacillus and producing typical tuberculosis in them. Infection may occur through wounds in the skin, through the alimentary tract, being taken in with food or drink, or lastly, and by far the most common way, through the lungs by respiration. The tubercle bacillus is a strongly parasitical bacterium and can develop nowhere outside the bodies of man and the warm-blooded animals, except in specially prepared culture-media kept at body temperature. Transmission must therefore take place from one individual to another. In order that this may take place through inspiration the medium conveying the bacteria must dry up and become a part of the dust floating in the air. It is impossible for bacteria to leave a moist surface. They must be dried to be carried about by the air. The tubercle bacillus is one of the most resistant of bacteria, and drying does not affect its virulence. After having been dried for months the bacteria begin to grow as soon as introduced into the body of a warm-blooded animal. Where do these

dried bacteria come from? It has been shown that the sputum of patients suffering from pulmonary tuberculosis contains millions of bacilli every day. Numerous investigators have shown that the dust of rooms which have been occupied by phthysical patients has contained virulent bacilli months after such occupation. It has been found that the most dangerous habit that the consumptive has is that of receiving his sputum into his handkerchief, which usually lies during the night on the bedclothes ready to be taken up during paroxysms of coughing.

There has been much discussion about heredity in connection with the transmission of tuberculosis. In considering such discussion it must ever be borne in mind that tuberculosis is a contagious disease caused by a specific bacillus. A feeble constitution may, indeed, be inherited, but however great the predisposition, tuberculosis cannot occur without the tubercle bacillus. Without question the chief source of infection is the inhalation of the dried sputum of the lungs of phthysical persons.

In 1883, at the time of a threatened outbreak of Asiatic cholera in Europe, the German imperial government sent a commission, with Robert Koch at its head, to India to investigate the disease. Koch was soon able to report that he had found the cause of the disease—a bacterium, of which he obtained pure cultures. Owing to its peculiar shape it was called by him the *comma bacillus*, although later investigations proved that these rods were only fragments of a true spirillum. Koch found this bacterium in the dejections of every case of cholera examined, and later proved that it occurs only in this disease. As the lower animals are not susceptible to cholera, the final step in the demonstration of its causal relation to the disease—viz., inoculation with pure cultures—could not be carried out. By a fortunate accident, however, during a course of lectures on cholera in Berlin one of the attendants, having neglected some necessary precaution, was infected by the bacteria and had an attack of true Asiatic cholera. As he recovered, his loss was slight, while the gain to science was immeasurable.

The comma bacillus is received into the body though the digestive tract, with the food or frequently with the drinking-water. This bacterium has very weak powers of resistance and is readily killed by the normal acid secretion of the stomach. When through disease or other cause the gastric juice is only faintly acid or neutral, the bacteria pass through uninjured and in the intestines find their ideal culture-medium. This bacterium thrives only in moisture, dryness being an impassable obstacle. As the comma bacillus leaves the body only in the discharges from the alimentary tract, the danger of acquiring the disease is slight to one who understands the nature of the infection.

(To be continued.)